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EXAMINER	
ETHERTON, BRADLEY	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/583,572	KOWOLL ET AL.	
	Examiner	Art Unit	
	Bradley Etherton	1772	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 February 2011*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3 and 6-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3 and 6-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 June 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This is a response to Applicant's amendment filed on February 14, 2011.

Claims 1-3 and 6-11 are pending in the application.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-3 and 7-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Hashimoto**, et al. (U.S. 4,350,665), in view of **Dunster**, et al. (U.S. 4,865,820).

In regard to claim 1, **Hashimoto** discloses a reactor which is useful for conducting gas phase catalytic reactions which require good gas mixing (Abstract). The reactor is effective for mixing streams of hydrocarbon and air before they contact a catalyst (col. 4, line 49 to col. 5, line 18). Therefore, the reactor is considered suitable for conducting reaction involving oxidations, e.g., partial oxidation reactions or oxy-dehydration reactions. The reactor is designed as follows (col. 2, line 44 to col. 4, line 25:

(a) The gas mixture flows axially through the reactor (Stream PrG in Figure 1).

(b) A gas distributor is mounted directly above the catalyst bed. **Hashimoto** discloses a gas distributor which consists of a circular pipe with multiple perforations or multiple nozzles. In the example, the velocity from the distributor ranges from 46.5 to 63 m/sec, while the process gas velocity is 0.40 or 0.77 m/sec (col. 4, lines 49-55). Since the velocity from the distributors is 60 to 160 times faster than the process gas, the flowing gas is considered to correspond to jetting gas stream jetting into the process gas stream.

(c) The distance between the gas distributor and the catalyst bed is at least 0.18 x ID, where ID is the internal diameter of the reactor. 0.18 x ID is the sum of 0.06 x ID (section II shown in Figure 9A and col. 3, lines 24-28) and 0.12 x ID (section III shown in

Figure 9A and col. 3, lines 52-55). **Hashimoto** is silent regarding the internal diameter of the reactor.

(d) The perforations are located at different points around the circumference of the gas distribution pipe (Figure 4). The gas streams may be directed at angles ranging from 90° to 135° relative to the axis of the reactor, i.e., parallel to or away from the catalyst bed (col. 3, lines 4-13). Flow from the circular distributor may be radially inward (Figure 7C). Therefore, the jetting gas stream is considered to be introduced at an inclined angle relative to the axis of the reactor, i.e., at an inclined angle relative to vertical.

(e) The gas distributor may be a circular pipe equipped with nozzles or perforations (Figure 7C). More than one gas distributor may be used. Therefore, **Hashimoto** is considered to disclose multiple concentric gas distributors.

Hashimoto does not appear to explicitly disclose (1) that the process involves oxy-dehydration, (2) that the jets are directed toward the catalyst, (3) that the distributor 50-300 mm above the catalyst bed, or (4) that the dwell time is < 1 sec in the space above the catalyst bed.

However, **Dunster** discloses a catalytic partial oxidation process and an apparatus for mixing and distributing gas streams in the reactor (col. 1, lines 6-11). The gas streams contain air and hydrocarbon and are considered to be equivalent to the air/hydrocarbon gas streams disclosed by **Hashimoto**. Partial oxidation is considered to be equivalent to oxy-dehydration. The process involves the following:

(a) A cylindrical reactor which contains beds of monolithic partial oxidation catalyst.

(b) The gases enter the top of the reactor (through inlets #66 and #70) and exit the bottom of the reactor. Therefore, the flow is considered to be largely axial flow.

(c) The mixture of hydrocarbon and oxidant flows directly toward the catalyst surface through a series of parallel diverging nozzles. Therefore, **Dunster** discloses that the flow may be directed onto the catalyst surface.

(d) **Dunster** discloses the gas velocity exiting the divergent nozzles is about 9 m/sec (col. 7, lines 37-44).

In regard to the height of the distributor above the catalyst surface, **Dunster** discloses a reactor with a diameter of 0.91 m (col. 7, lines 18-21). **Hashimoto** discloses that the distance between the gas distributor and the catalyst bed is at least 0.18 x ID, as discussed above. Therefore, the gas distributor should be located at least 163.8 mm above the surface of the catalyst bed (0.18ID) for the reactor diameter disclosed by **Dunster**. Since a range of 163.8 mm and greater above the catalyst bed falls in the range of 50 to 300 mm above the catalyst bed, the range recited in claim 1 is considered *prima facie* obvious.

The dwell time in the space above the catalyst bed can be calculated for the case in which the distributor is 163.8 mm above the catalyst. **Dunster** discloses the following dimensions and flow rates (col. 7, lines 11-20):

(a) The distance between the nozzles and the catalyst bed is 0.163 m.

(b) The diameter of reactor is 0.91 m.

(c) The total flow rate through the reactor is about 2.8 m^3/sec.

This corresponds to a dwell time of about 0.04 sec. Since a dwell time of 0.04 sec falls in the range less than 1 sec, the range recited in claim 1 is considered *prima facie* obvious.

Therefore, at the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the process of **Hashimoto** and direct the flow of the oxygen-containing gas downward toward the partial oxidation catalyst as taught by **Dunster** because (1) this involves application of a known technique to improve a known process to yield predictable results and also because (2) flow of oxygen in the direction of the catalyst is a known means for effectively bringing oxygen into contact with a partial oxidation catalyst and (ii) turbulent gas flow is an effective means for avoiding flashback and for mixing the reactant gases (**Dunster**, col. 2, lines 40-48).

In regard to claim 2, **Hashimoto** discloses an example in which the jetting is toward the center of the reactor (Figure 7C).

In regard to claim 3, **Hashimoto** discloses that the gas may be blown in the centripetal direction, i.e., tangentially to the reactor wall (col. 1, lines 39-42). **Hashimoto** also provides an example of a gas distributor in which the gas is blown tangential to the reactor wall (Figure 7B). As discussed above, each of the concentric ring distributors has multiple rows of nozzles on the pipe (Figure 4). Therefore, each circular distributor pipe is considered to have nozzles which blow gas in alternating alignments. Arranging the gas distributor such that jets are produced by only those nozzles that alternate in flow direction corresponds to rearranging the existing parts of

the gas distributor in order to optimize the process. It is well settled that the rearrangement of parts has no patentable significance unless a new and unexpected result is produced. See MPEP 2144.04, Sec. VI.

In regard to claim 11, **Hashimoto**, in view of **Dunster**, discloses a reactor comprised of a catalyst bed and a gas distributor pipe, as discussed above. In particular:

(a) The gas distributor may be comprised of more than one concentric ring.

(b) The distribution pipes have a series of perforations or nozzles. An oxygen-containing gas is jetted through the nozzles.

(c) The gas distributor is located above the catalyst bed.

(d) Largely axial flow of the gas mixture occurs through the catalyst bed

(e) The perforations may blow the oxygen-containing gas onto the catalyst surface. The perforations/nozzles are located around half of the circumference of the pipe. Therefore, when the central perforations are directed straight at the catalyst surface, most of the jets are at an angle inclined away from the vertical.

(f) The overall reactor dimensions and flow rates are such that the gas distributor is positioned in a plane at least 163 mm above the catalyst bed and the oxygen dwell time is about 0.04 second. Since (1) a range of at least 163.8 mm above the catalyst bed falls in the range of 50 to 300 mm above the catalyst bed and (2) a dwell time of 0.04 second falls in the range less than 1 second, the ranges recited in claim 11 are considered *prima facie* obvious.

In regard to claim 7, **Hashimoto** discloses that the jets may be directed toward the center of the reactor, as discussed above.

In regard to claim 8, **Hashimoto** discloses that the nozzles may be located at different positions around the circumference of the pipe, as discussed above. **Hashimoto** further suggests that the spacing between adjacent nozzles may change along the length of a distributor pipe (Figures 4 and 2). Therefore, each circular distributor pipe is considered to have adjacent nozzles which blow gas in different directions. Arranging the gas distributor such that adjacent nozzles produce jets that flow in different directions is considered to correspond to rearranging the existing parts of the gas distributor in order to optimize the process. It is well settled that the rearrangement of parts has no patentable significance unless a new and unexpected result is produced. See MPEP 2144.04, Sec. VI.

In regard to claim 10, **Hashimoto** discloses that the gas may exit the distributor through perforations, i.e., holes, or nozzles, as discussed above.

In regard to claim 9, **Hashimoto** discloses that each of the concentric ring distributors has multiple perforations around the pipe circumference, as discussed above. Therefore, nozzles which blow gas in alternating alignments are considered to be present. Arranging the gas distributor with only those nozzles that produce jets that alternate in flow direction is considered to be rearranging existing parts of the gas distributor in order to optimize the process. It is well settled that the rearrangement of parts has no patentable significance unless a new and unexpected result is produced. See MPEP 2144.04, Sec. VI.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Hashimoto**, in view of **Dunster**, as applied to claim 11 above, and further in view of **Zardi** (U.S. 4,372,920).

In regard to claim 6, **Hashimoto**, in view of **Dunster**, discloses the reactor of claim 11, as discussed above, but does not appear to explicitly disclose that the reactor further comprises (c) a central gas inlet pipe which centrically penetrates the catalyst bed and (d) has a mixing dome above the catalyst bed and that the ring distributor surrounds the central gas inlet pipe.

However, **Zardi** discloses a reactor for conducting heterogeneous catalytic reactions involving gaseous reactants (Abstract). The reactor is designed as follows:

(a) A central gas inlet pipe leads from the bottom of the cylindrical reactor to the top of the reactor. Therefore, the central inlet pipe introduces the gas feeds from the bottom of the reactor rather than from the top of the reactor as taught by **Hashimoto**.

(b) The top of the reactor is closed with a dome. Gas flows the length of the inlet pipe, contacts the dome, and flows in the opposite direction. Therefore, the dome is considered to correspond to a mixing dome.

(c) One or more modular catalyst cartridges, i.e., catalyst beds, surround the centrally located inlet pipe. Therefore, the pipe is considered to penetrate the catalyst beds.

In regard to the location of the circular gas distributors, **Hashimoto** discloses that these distributors are located about the central axis of the reactor. Therefore, the

circular gas distributors are considered to surround any central gas inlet pipe that penetrates the catalyst bed and passes to the top of the reactor.

Therefore, at the time of the invention, it would have been *prima facie* obvious to one of ordinary skill in the art to modify the reactor of **Hashimoto**, in view of **Dunster**, and substitute the central inlet pipe and closed dome of **Zardi** for the upper feed inlet taught by **Hashimoto** because (i) it involves the simple substitution of a known reactor design that is effective for introducing the reactant gases and (ii) the design of **Zardi** offers a simple internal structure that is easily accessible for maintenance and offers limited pressure drop (**Zardi**, col. 2, lines 14-19).

Response to Arguments

Applicants argue that the gas distributor design of **Hashimoto** is such that the space between the distributor and the catalyst bed will have an oxygen dwell time of more than 1 second in "a space above the catalyst bed." Applicant's arguments suggest that Applicants consider "a space above the catalyst bed" to be the total combined space between the top of the reactor and the top of the catalyst bed, not just the space between the distributor and the catalyst bed. In response to the argument that the space includes any free space between the top of the bed and the top of the reactor, and that the dwell time in that space is greater than 1 second, a change in the size of the reactor, i.e., increasing or decreasing the space above the catalyst bed, is not considered patentably distinct unless a new or unexpected result is obtained. See MPEP 2144.04, Sec. IV. The space between the gas distributor of **Hashimoto** and the

catalyst bed, assuming a reactor diameter as taught by **Dunster**, will be about 163 mm deep, as discussed above. Average gas velocities of about 0.4 or 0.77 m/sec (**Hashimoto**, col. 4, lines 49-54) correspond to dwell times of about 0.2 to 0.4 seconds. Average gas velocities of about 9 m/sec (**Dunster**, col. 7, lines 37-41) correspond to dwell times of about 0.02 seconds. Therefore, dwell times of less than 1 second are considered reasonable, based wither on **Hashimoto** or **Dunster**.

Applicants argue that **Dunster** fails to remedy the deficiencies of **Hashimoto** because **Dunster** does not teach free jets that flow in the direction of the catalyst bed. Applicants also argue that one would not look to **Dunster** because of the very short residence times. In response to the first argument, **Dunster** was not relied upon to teach the formation of jets. Rather, **Dunster** was relied upon to teach conventional reactor sizes, partial oxidation catalysts, mixtures of air and hydrocarbons, and directing a stream toward the catalyst bed. Applicants' arguments are considered to be arguments against the references individually. However, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In response to the second argument, **Dunster** teaches that the overall gas velocities may be less than the gas velocities disclosed by **Hashimoto**. However, due to the proximity of the gas nozzles relative to the catalyst, the dwell times are considerably shorter in **Dunster** than in **Hashimoto**. It is the Examiner's position that one of ordinary skill in the art would recognize that the short residence time is simply

due to the close proximity of the gas distributor and the catalyst bed and understand that residence time is not fixed to a single value, but that residence time may be adjusted by simply changing the distributor position.

In summary, Applicants' arguments have been carefully considered, but are not considered persuasive. Therefore, the previous rejections of claims 1-3 and 7-11 are under 35 U.S.C. 103(a) are maintained.

It is noted that the gas supply to the partial oxidation reactor of the instant application (i) enters through a central inlet pipe, (ii) has an outlet located between the catalyst bed and the jets of air directed toward the catalyst bed, and (iii) directs the process gas counter-current to the jets of air as it exits the pipe, but flow co-currently with the jets as the process gas approaches the catalyst bed (Figure 1). These features appear to distinguish the instant application from the prior art of record, yet are not included in the limitations recited in claim 1.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

(a) **Reed**, et al. (U.S. 4,166,834) discloses an air injector for mixing jets of air with hydrocarbon prior to contact with a catalyst bed.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bradley Etherton whose telephone number is (571) 270-5478. The examiner can normally be reached on Monday through Friday, 7:30 a.m. to 5:00 p.m. EST, with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, InSuk Bullock can be reached on (571) 272-5954. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic

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/Bradley Etherton/
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